

Adaptation of CM-SAF target accuracy to orographically induced increase of natural global shortwave irradiance field variability

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Among the four components of the surface radiation budget, the shortwave downward irradiance is the most variable one, in space as well as in time. The current practice of assessing the reliability of satellite-based estimates of this component by comparing it with surface measurements meets its limits there, where the measuring site is by no means representative of the area subtended by the corresponding pixel, that is there, where the site yields nothing more than mere point measurements.

In the majority of the validated areas, the CM-SAF products, that is, estimates of monthly values averaged over 15 km x 15 km tiles, meet their target accuracy as they differ by less than 10 Wm⁻² from the measured values. However, several regions remain, where the above-mentioned limitation renders such results unattainable. Most obvious examples among them are the mountainous and coastal ones.

We analyse the influence of these limitations in the Alpine region in a twofold way. Firstly, we study the variability of estimates among all HRV pixels contained within the 15 km x 15 km tiles in function of the tiles' geographical location across the Alps. This allows quantifying the increasing scatter of the individual pixel with respect to the tile average as the terrain complexity increases. Spatial radiation climate variability is implicitly accounted for at this step, because it is most frequently coupled with terrain complexity. Secondly, we investigate the spatial variation of the irradiance field at the sub-pixel scale by mapping the HRV-based estimates on the terrain by means of a highly resolved (300 m mesh-width) DEM derived from the SRTM data. This step allows quantifying the extreme deviations of point measurement with respect to the pixel's average. It also defines the limits within which the estimated average can be considered as (potentially) correct.

Combining both scattering amplitudes leads to an assessment of the attainable performance of current validation procedures as a function of regional terrain complexity. An RMSD difference of 20% in tiles located along the crest of the Alps does not allow concluding that the retrieval algorithm is not suitable there. It only means that the technical possibility for operating a site which is representative for the average in the area subtended by the pixel is much smaller than in unobstructed flatlands with uniform land-use, i.e., than in areas with a validation RMSD of 5%. These results sup-

plement the quality as-sessment while generation of consistent long-term time series on large geographical scales progresses.